



OSIsoft®

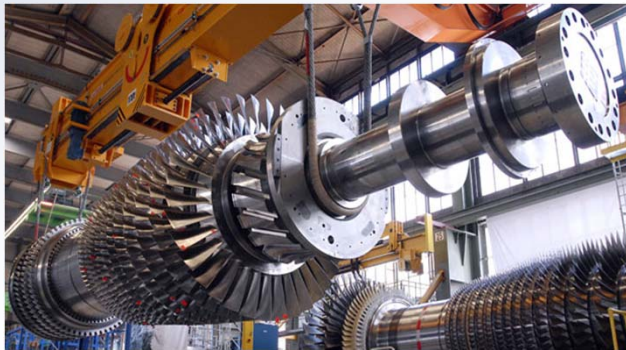
The Power of Data

OSIsoft - A leader in Power Generation Leveraging Technology to Optimize Operations and Maintenance

February 23rd, 2012

David Thomason

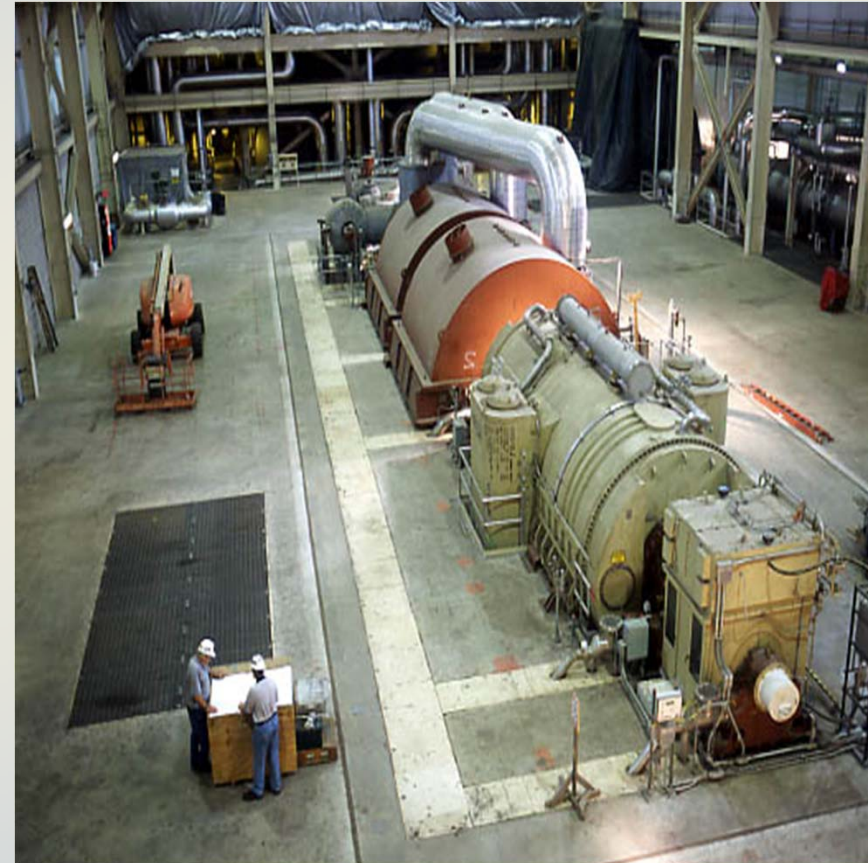
OSIsoft Business Development Executive – Global Power Generation



Agenda / Topics



- ❑ OSIssoft and Generation
- ❑ GenOn PI Experience
- ❑ Proactive Maintenance
- ❑ Operations
- ❑ New Analytical tools



OSIsoft Capabilities



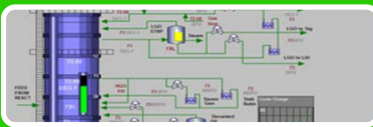
Acquire Data

- Interface systems and acquire streaming data and events



Historize

- Store at resolution of acquisition and trend on demand



Present

- Engineered and Ad-Hoc displays



Analyze

- Pre & Post processing including simple to complex calculations



Organize

- Structure PI data through PI Points, PI Elements and PI Events



Monitor

- Process rules & Notify, Alert on event



Integrate

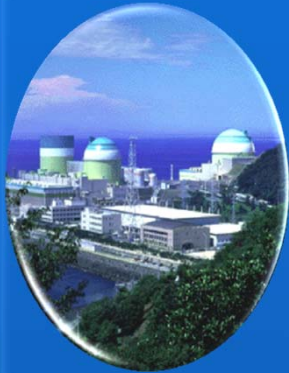
- Data Exchange with other Systems

Power & Utilities Industries Overview



Power Gen Thermal

- Coal
- Gas
- Oil



Power Gen Nuclear

- Generation
- Fuel
- Regulators
- Services



Power Gen Renewables

- Wind
- Solar
- Hydro
- Marine
- Bio
- Geo



Water

- Utilities
- Desalination
- Irrigation
- Industrial
- Metering
- Lifecycle



T&D – Smart Grid

- Grid Mgmt
- Phasor
- Substation
- Dist. Automation
- Dist. Generation
- Microgrids



AMI-Smart Grid

- Operational Data Manager
- MDUS
- Home Area Net
- Demand Response

Power & Utility Verticals

OSIsoft Power and Utilities Experience



Monitored and Optimized with the PI system

- Approximately 60% of USA generation
- 90% of the ISOs/RTOs in the USA
- 75% of nuclear power generators in the USA
- The US Nuclear Regulatory Commission (US NRC)
- 20 GW of wind generation in the USA
- 17 of the top 20 wind generating producers in the world
- Over 50% of the Concentrated Solar Plants (CSPs) in the world
- Over 100 water utilities in 17 countries

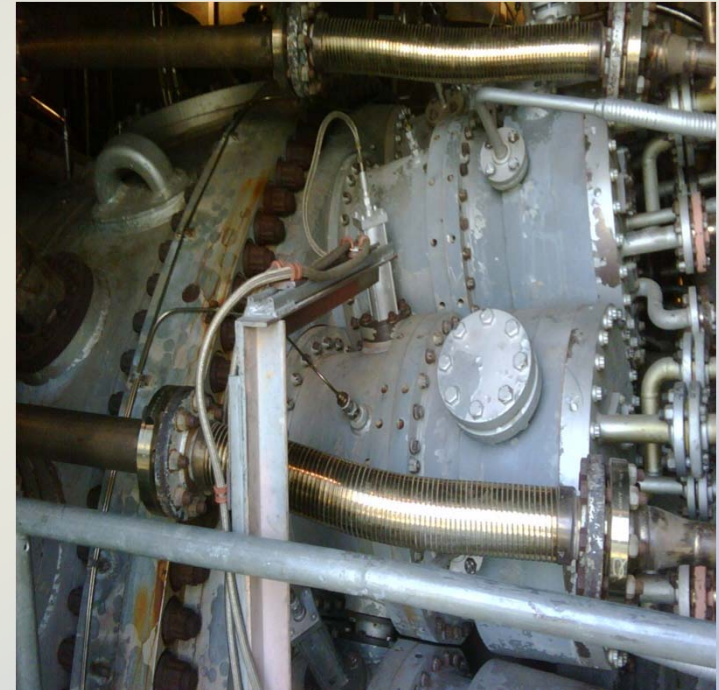
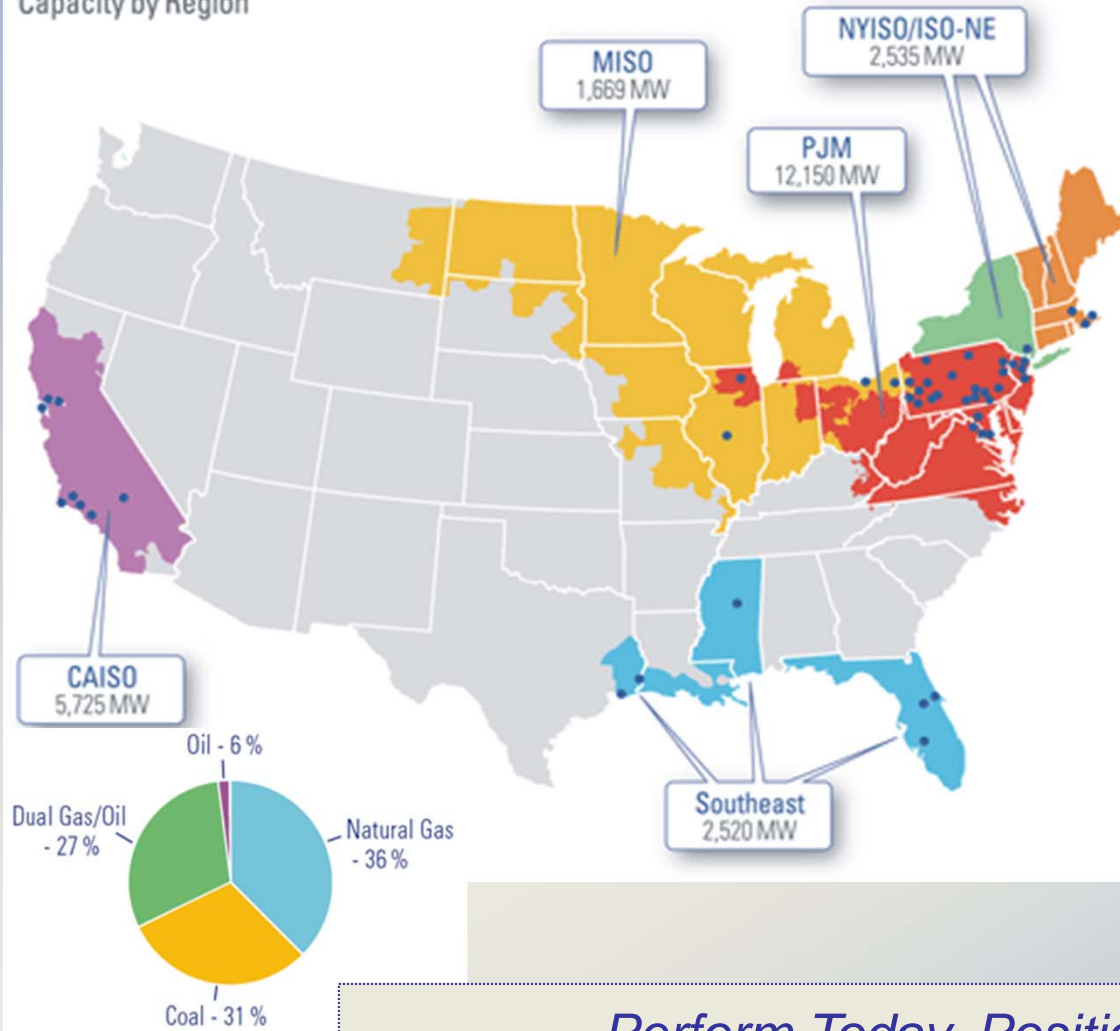
The PI System - A "De facto" Standard in Power Generation



GenOn Generation Fleet & Fuel Type



Capacity by Region



Perform Today, Position for the Future

Driving Factors for Power Generation Enterprise Wide Infrastructure



Problem: Many disparate plant systems and the need to turn data into actionable information

- DCS, PLC, CEMS, Analyzers...
- Various timestamps
- Data accessibility & integrity

Solution: OSIsoft, Enterprise Wide Infrastructure

- Common real-time database
- Common visualization and analytic toolset
- Common platform for notifications, development and advanced analytics
- Leverage SMEs (Central, Plant, Vendors)
- Remote Monitoring & Diagnostics

Increase availability, lower lost margin

OSIsoft Continuous Value Proposition



Phases of Value

- Plant Fleet Wide Deployment
 - Notifications
 - Handheld – PI manual data \ Asset Sentry
- Condition Based Maintenance – Critical Assets
- Advanced Pattern Recognition (APR)
- Boilers ! Water Chemistry Automation
- Environmental Monitoring
- Proactive Maintenance Data Gateway

Every phase a business value and positive ROI

OSIsoft PI - Interfaces (Get Everything!)



Fleet wide real-time data and event infrastructure

- 39 PI Servers, 210+ Interfaces
- 1000+ real-time process displays & reports
- Estimated 450K tags (real-time data points)
- Electronic notifications
- ProcessBook, DataLink, WEB ActiveView, RT WEB, ACE,...

Connect / Collect via PI Interfaces:

- 40 + Control Systems (DCS)
- 100 + recorders
- 30 vibration systems, 30 Environmental CEMS, Analyzers
- 20 + PLC's, Other various I/O telemetry and meters...

Get all the data to create a complete correlated database

Multi Uses for PI information



- Proactive / Condition based Maintenance
- Operations (extend DCS beyond the Control Room)
 - Controllable Losses – Start Up / Shut Down
- Root Cause Analysis (RCA)
- Outage Planning (spend on the right things)
- Vendor Performance (Pre and Post work review)
- Equipment / Manufacture Performance
- Plant and System Performance / Efficiency
 - Production vs schedule - Heat rate – Condenser – Boiler / HRSG
- Environmental (Compliance, emissions, limits, reporting)
- Water Chemistry / Boilers
- Security (NERC CIP, ...) Passive access to Plant information
- Fleet / enterprise view of core metrics and KPIs

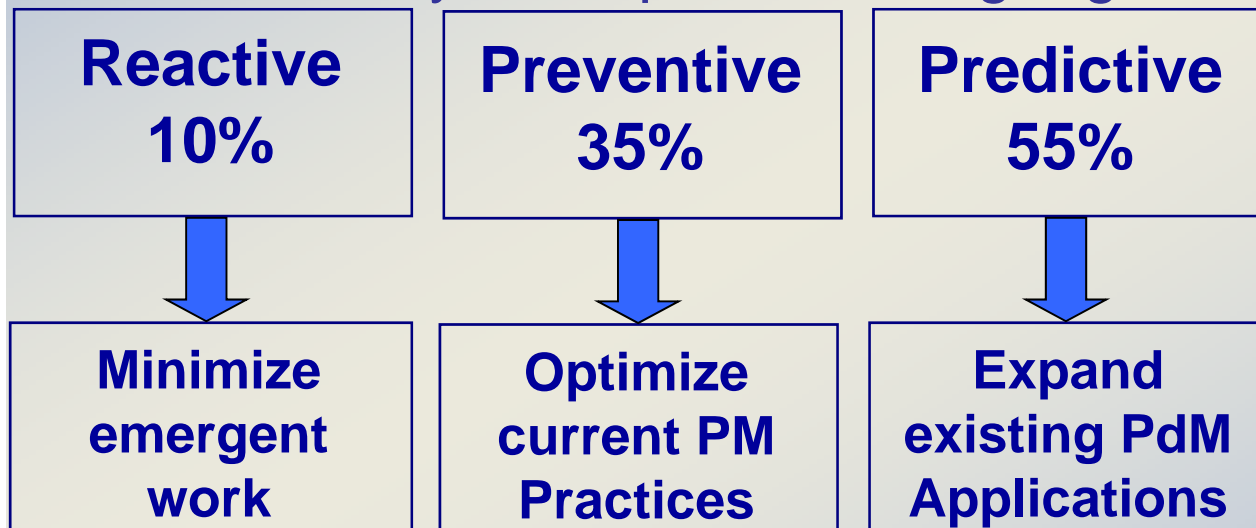
Single version of the truth

Proactive Maintenance



- Proactive Maintenance is a strategy in which Corrective, Preventive, and Predictive processes complement one another.
- The average industrial plant performs **more than 55% Reactive** maintenance work. Reactive is the highest cost!
- The top industrial plants perform **less than 10% Reactive** maintenance work.

An industry “best practice” target goal maintenance mix



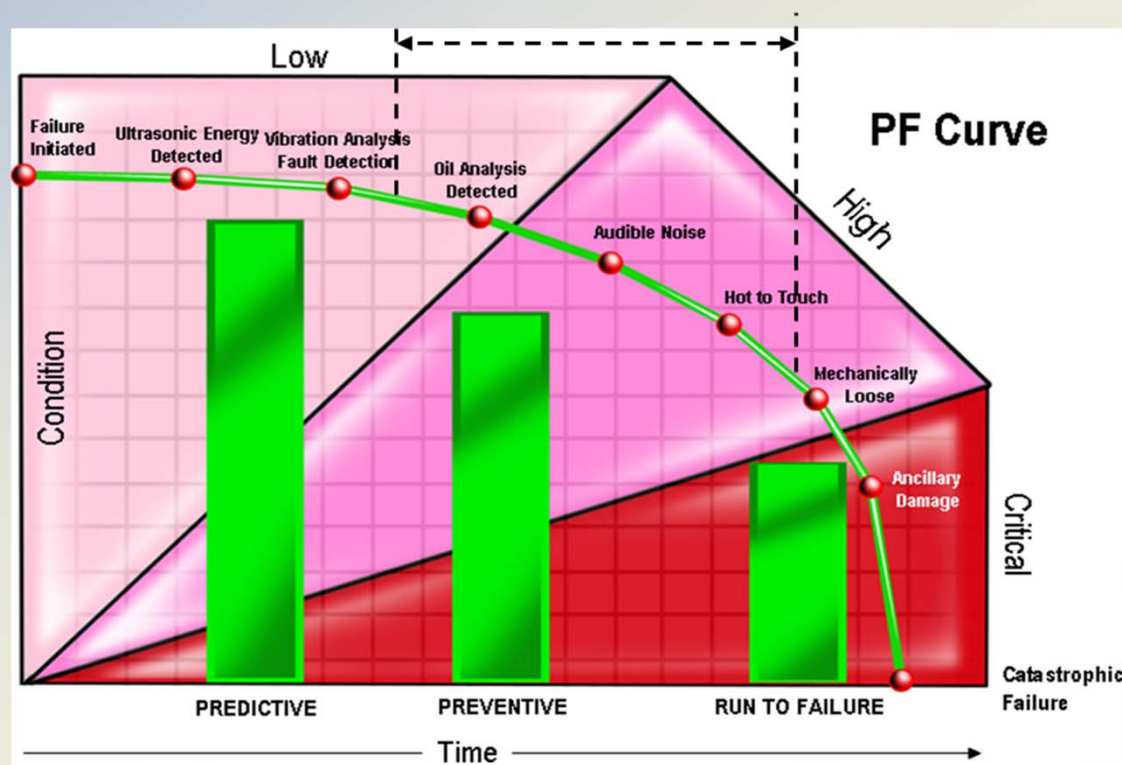
- In support of this strategy, enhance & expand the effective use of real time and historical data and analytical systems.

Proactive Maintenance P-F Curve



The P-F curve is to show the behavior of equipment as it approaches failure.

- The P on the curve is the first possible point when equipment degrades or changes can be detected.
- The F is the point of equipment or system failure.
- The time between is your “opportunity” to avoid unplanned events



P-F Interval

**Time frame to rectify impending equipment failure
(Planning / Scheduling / Execution Window)**

Earliest detection provides the greatest opportunity time

Source: Allied Reliability

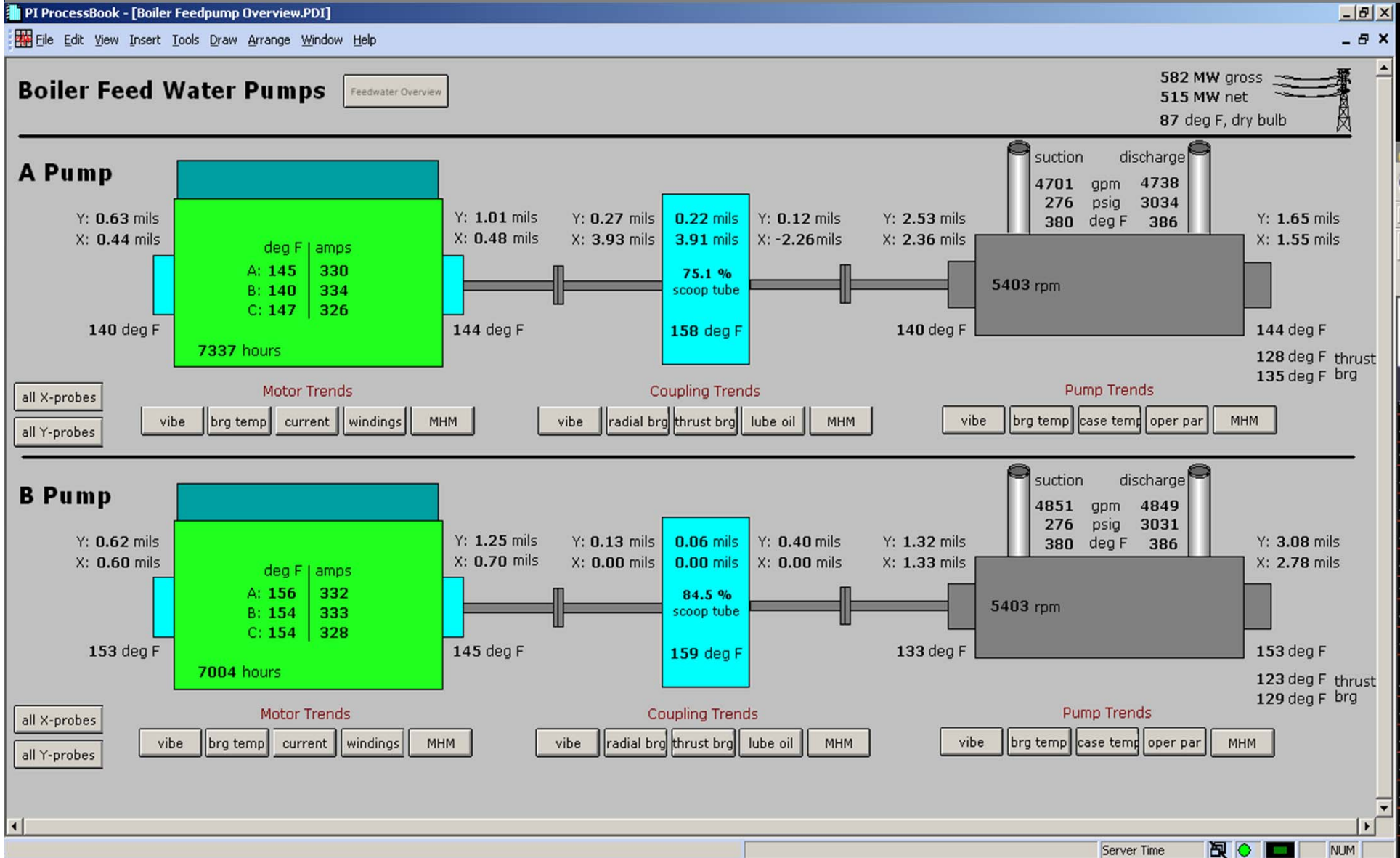
12

Proactive Maintenance



- Screens and information with Maintenance in mind
- A focus on critical equipment, parameters for condition
 - Vibrations (rotating equipment, motors, pumps, turbine...)
 - Temperatures (bearings, oil, metal, motors...)
 - Amps
- Transform data and use in a new, valuable way
- Use out of the box, PI System functionality
 - Totalizers for run time counters, compare / balance usage, schedule maintenance, measure accumulative damage
 - Multi-state graphics
 - Notifications
- Increase speed and accuracy of decisions

Proactive Maintenance Monitoring



Proactive Maintenance Monitoring



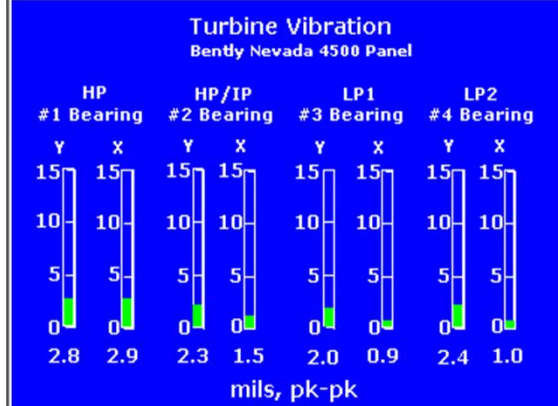
PI ProcessBook - [Steam Turbine Overview.pdi]

File Edit View Insert Tools Draw Arrange Window Help

74%

Steam Turbine

584 MW gross
516 MW net
85 deg F, dry bulb

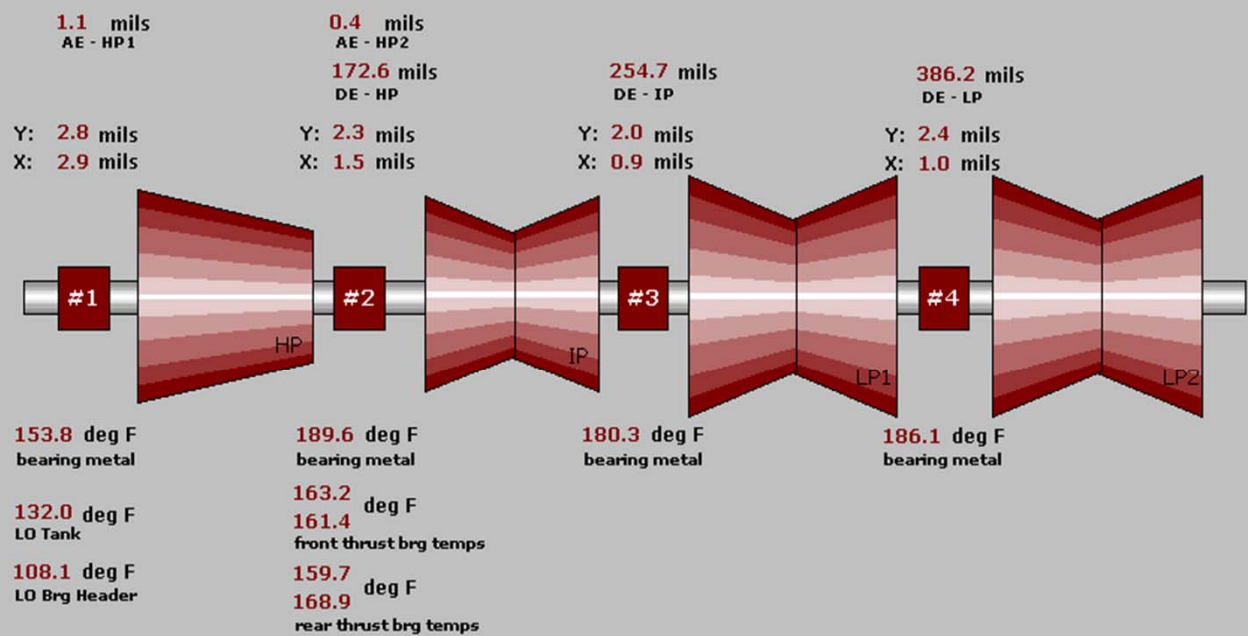


vibration trends

#5, #6
#3, #4
#1, #2
all Y-probes
all X-probes
expansion

temp trends

#5, #6, #7
#3, #4
1, 2, thrust
lube oil
Generator



Ready Server Time NUM

Condition Based Maintenance Screens



UNIT 1
149.13 MW

Discharge Flow

Total Head - 1A =

BFP 1A SUCT ST
BFP 1A SUCT PR
BFP 1A DISCH P
BFP 1A DISCH F
TOTAL HEAD
THRUST HOUSIN
NDE SLEEVE BR
DE SLEEVE BRG

Get Runtime Tags yes

12010:	BFP 1A Runtime Hours when	-BFP1A.RT
12011:	BFP 1B Runtime Hours when	-BFP1B.RT
12012:	BFP 2A Runtime Hours when	-BFP2A.RT
12013:	BFP 2B Runtime Hours when	-BFP2B.RT
12015:	Condensate Pump A Runtime	-COND_A.RT
12019:	Condensate Pump B Runtime	-COND_B.RT

TagID	Tag Name	Tag Descriptor
12012	BFP2A.RT	BFP 2A Runtime Hours when

Value (Hours):

Please add comment and initials.

Reset Runtime Counter

Instructions:

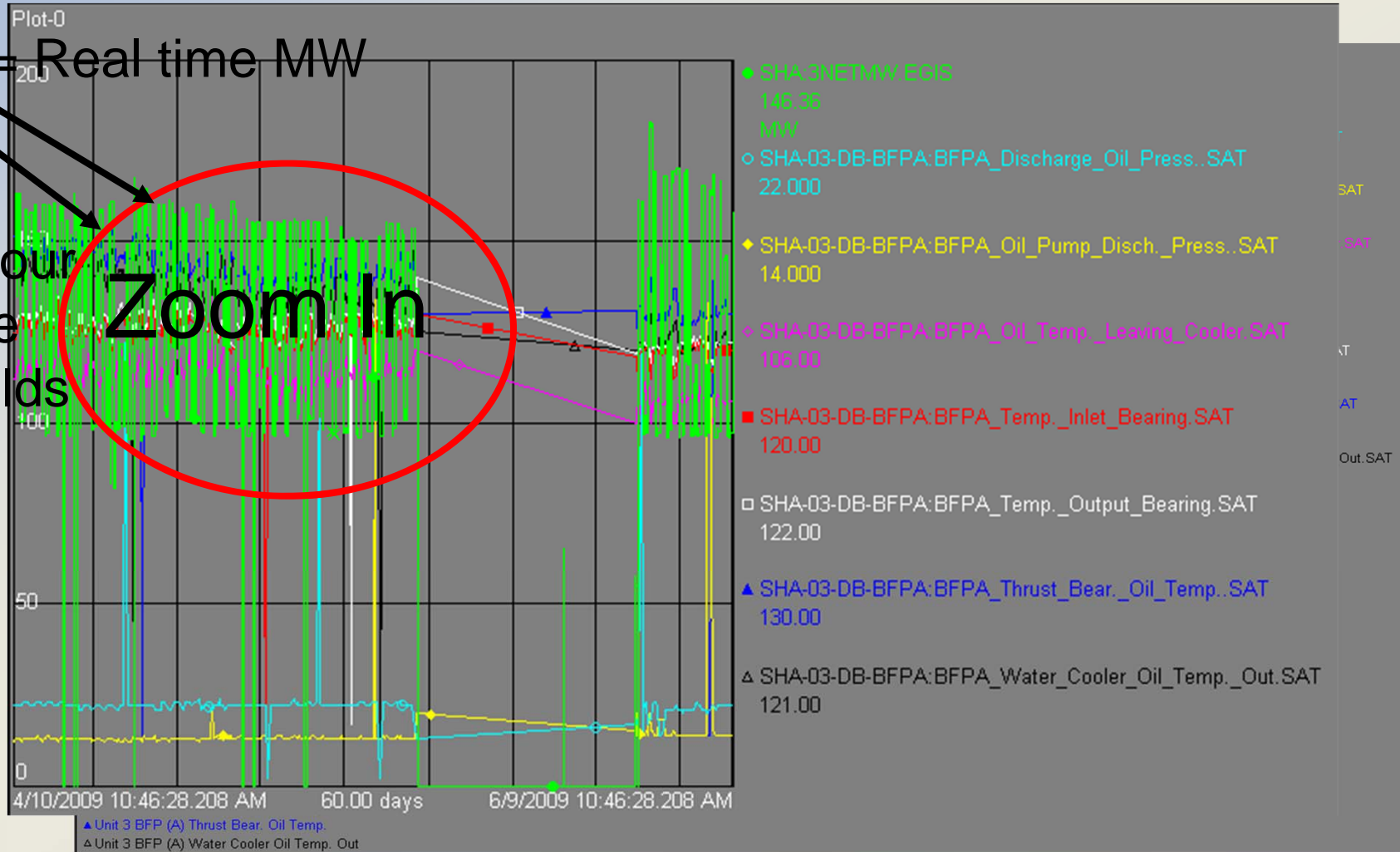
When the display loads it will pull back all *.RT (Runtime Counter) tags from the stations PI Server.

- Click on the runtime counter from the listbox that you would like to reset.
 - * - The Counter Information will be populated in the display below the listbox.
- Reset the Runtime Hours value in the text box next to the Value.
 - * - You can set this to any number of hours.
- Add comments and name or initials to the comments textbox.
- Click the "Reset Runtime Counter" button.

Manual Round Data Correlation



Green = Real time MW
Data Taken every hour from the handhelds



Boilers – Highest Loss Margin System



Most outages / de-rates are boiler related

- Transformation of data to useful information

Water Chemistry

Improve and interface to analyzers

- Cycle Water Chemistry screens
- Calculate minutes in / out of spec
- Notifications on limits
- Make visible via PI system



Boiler Tubes Temperatures

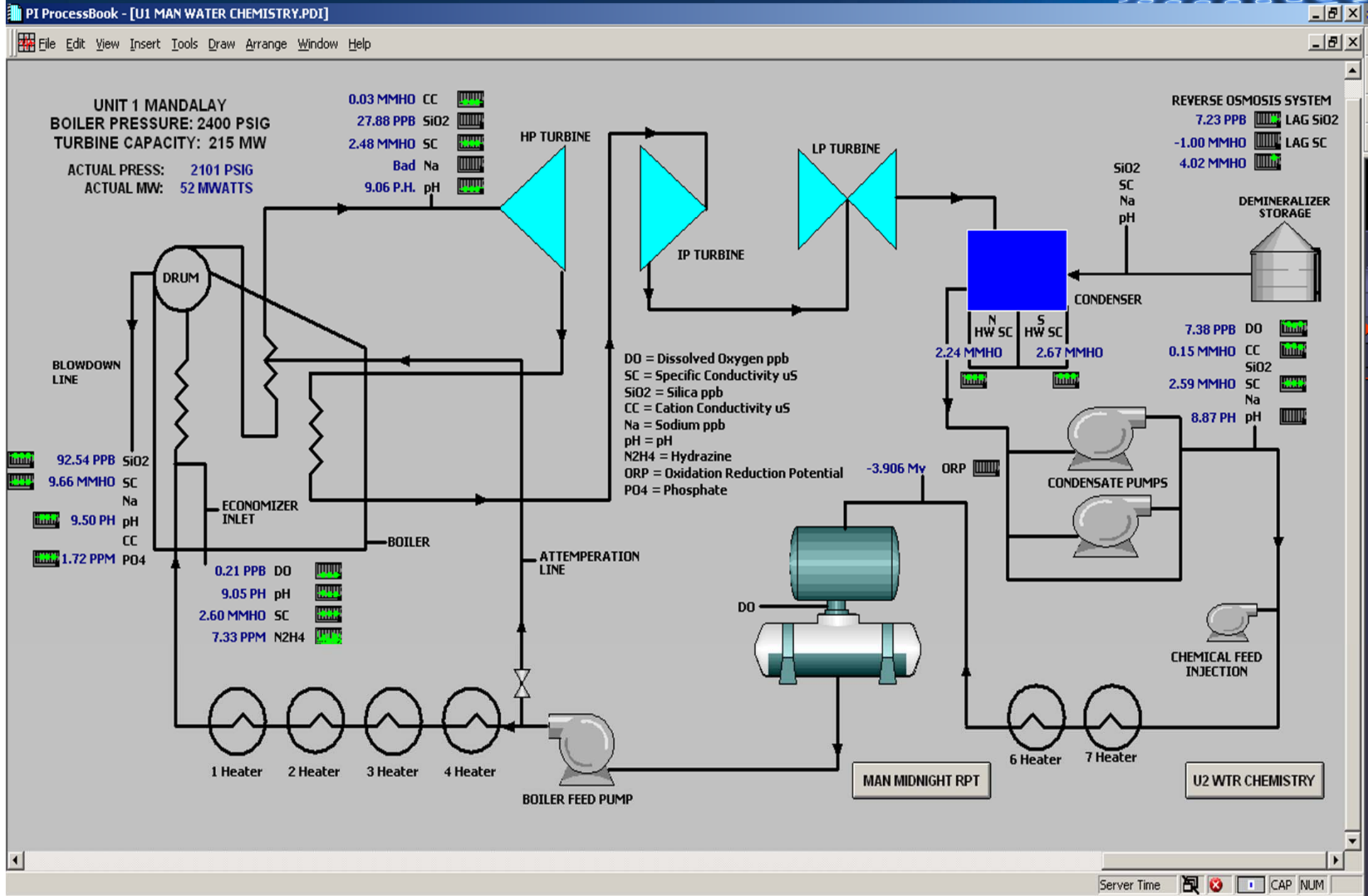
Systematically track:

- How many excursions?
- Length of excursions?
- Total time out of specification...
- Maintain instrumentation!



Transform and use data in a new way...

Water Chemistry Displays



Water Chemistry - Reports



PARAMETERS:

Condensate Pump Discharge

	EXPECTED RANGES
pH	9.2 - 9.6
CC - CPD A, $\mu\text{S}/\text{cm}$	< 0.2
Dissolved Oxygen, ppb	< 10
Sodium, ppb	< 3

Boiler Feedwater

	EXPECTED RANGES
pH	9.2 - 9.6
Cation Conductivity, $\mu\text{S}/\text{cm}$	< 0.2
Specific Conductivity, $\mu\text{S}/\text{cm}$	4 - 11
Dissolved Oxygen, ppb	1 - 10
Sodium, ppb	< 3

Boiler Water (Drum Blowdown)

	EXPECTED RANGES
pH - T1Drum Blowdown A	9.2 - 9.6
CC - T1 BLR 1 Water	< 1.0
SC - T1 Drum Blowdown	4 - 11
Silica - T1, ppb	< 60
Sodium - T2, ppb	< 300

Saturate Steam (Drum Steam)

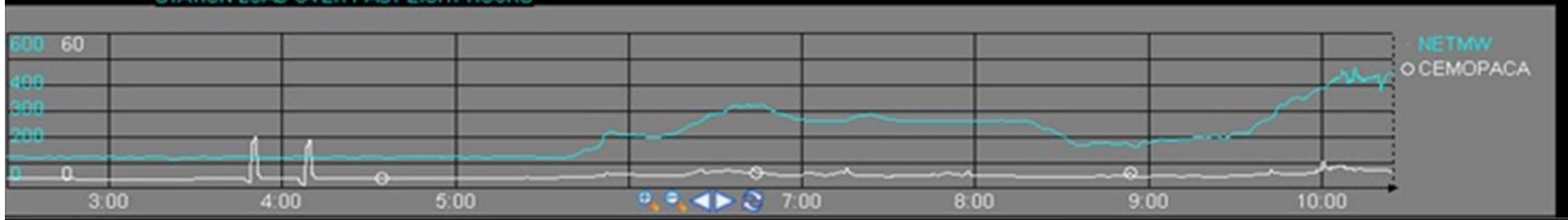
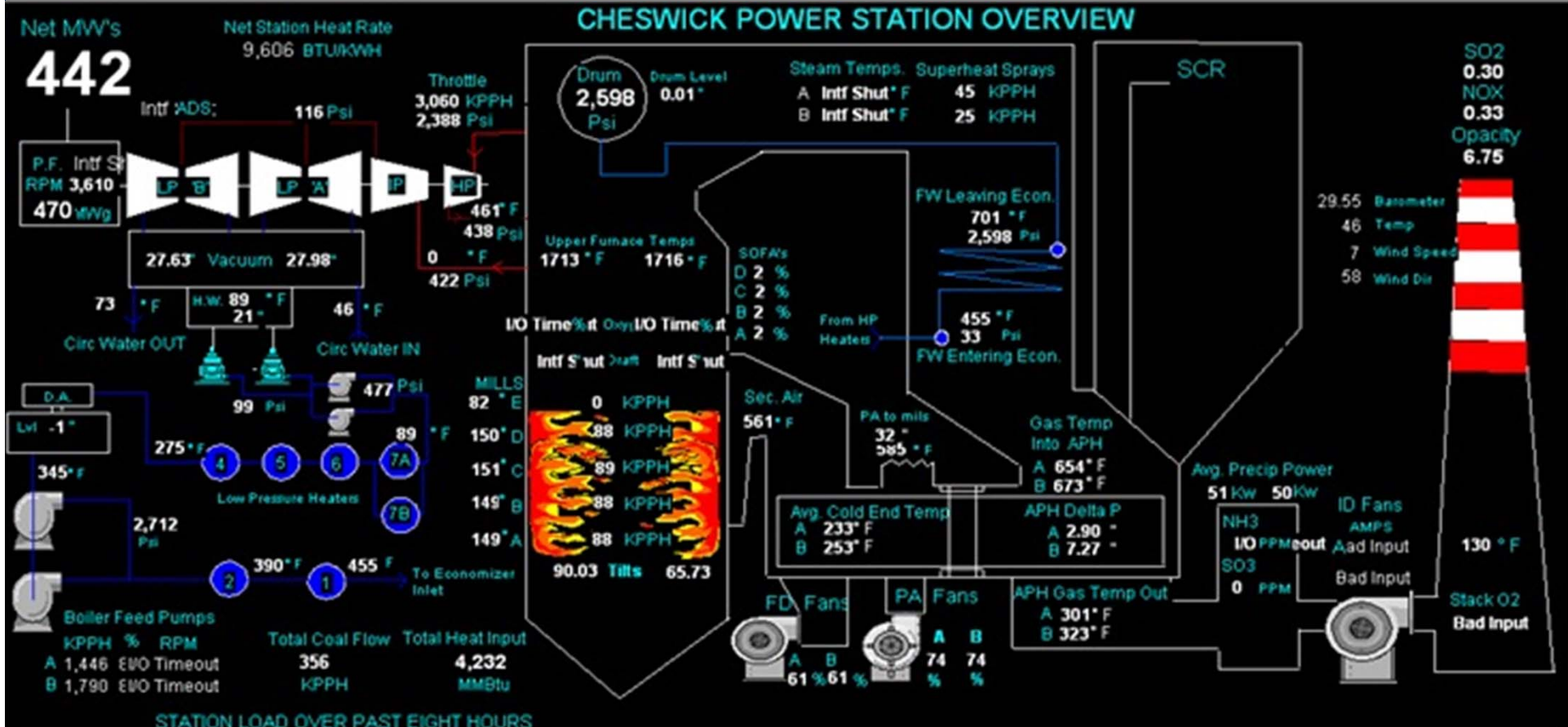
	EXPECTED RANGES
CC - T1 Drum Steam, $\mu\text{S}/\text{cm}$	< 0.2
Degas CC - T1 Drum Steam, $\mu\text{S}/\text{cm}$	< 0.2
SC - T1 Drum Steam, $\mu\text{S}/\text{cm}$	4 - 11
Silica - T1, ppb	< 10

Main Steam

	EXPECTED RANGES
Degas Cation Conductivity, $\mu\text{S}/\text{cm}$	< 0.15
Silica, ppb	< 10
Sodium, ppb	< 2

UNIT 1							
<u>MIN FOR DAY</u>	<u>AVG FOR DAY</u>	<u>MAX FOR DAY</u>	<u>MINS IN NORMAL</u>	<u>MINS IN ACTION LVL 1</u>	<u>MINS IN ACTION LVL 2</u>	<u>MINS IN ACTION LVL 3</u>	<u>MINS IN ACTION LVL 4</u>
9.40	9.43	9.46	1440.00	0.00	0.00	0.00	0.00
0.09	0.10	0.11	1440.00	0.00	0.00	0.00	N/A
2.55	3.03	3.53	1440.00	0.00	0.00	N/A	N/A
0.09	0.09	0.10	1440.00	0.00	0.00	0.00	N/A
9.31	9.32	9.33	1440.00	0.00	0.00	0.00	0.00
0.04	0.04	0.04	1440.00	0.00	0.00	0.00	N/A
7.86	7.90	7.99	1440.00	0.00	N/A	N/A	N/A
8.57	8.99	9.82	1440.00	0.00	0.00	0.00	N/A
0.12	0.13	0.15	1440.00	0.00	0.00	0.00	N/A
9.13	9.16	9.21	158.35	1281.65	0.00	0.00	0.00
0.20	0.22	0.24	1440.00	0.00	0.00	0.00	N/A
5.26	5.30	5.38	1440.00	0.00	N/A	N/A	N/A
41.69	44.11	49.17	1440.00	0.00	0.00	0.00	N/A
3.89	10.22	20.74	1440.00	0.00	0.00	0.00	N/A
0.13	0.14	0.15	1440.00	0.00	0.00	0.00	N/A
0.09	0.09	0.09	1440.00	0.00	0.00	0.00	N/A
7.70	10.28	16.36	1027.47	412.53	N/A	N/A	N/A
3.81	4.07	4.83	1440.00	0.00	0.00	0.00	N/A
0.10	0.10	0.11	1440.00	0.00	0.00	0.00	N/A
4.99	5.51	6.39	1440.00	0.00	0.00	0.00	N/A
0.11	0.12	0.13	1440.00	0.00	0.00	0.00	N/A

Operations



Non-routine Operations : Start-Up



START UP Ramagundam U#3

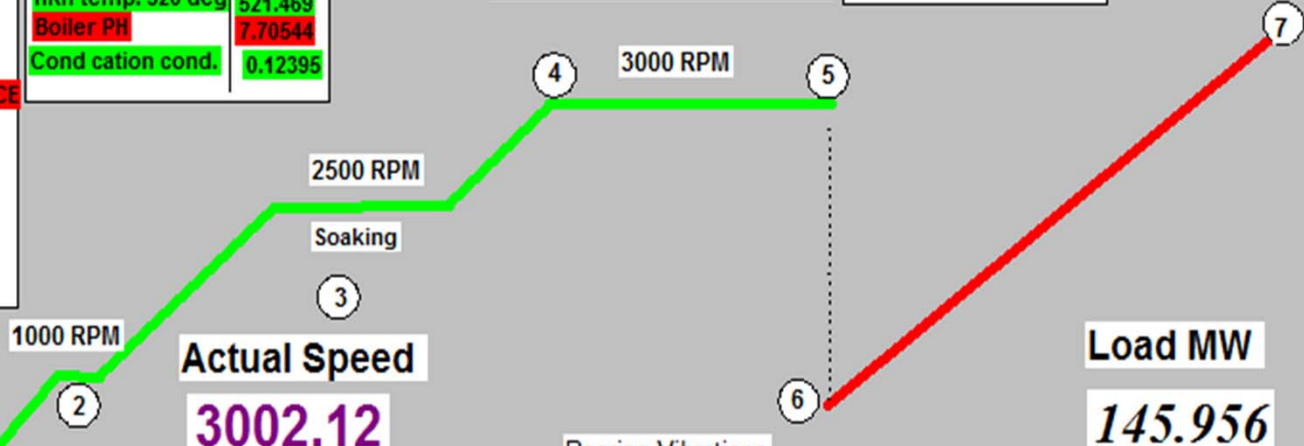
PRE START CHECKS	
H2 Pr: 1.85Kg/cm2	1.97473
H2 Purity:>98%	98.9995
MOT Level LO	NOT_LOW
Lube oil temp: 45 deg	46.8300
Vacuum	-693.366
Glnd stm temp>280Deg	239.405
M S line charged	151.630
HP/LP charged	OUT OF SERVICE
Dea stm charged	8.10537
Drum Lvl	-15.5041
Dea Lvl	2423.75
Hotwell Lvl	447.221
Turning Gear :	DISENGAGED

Rolling Parameter	
MS Pr : 75 Kg/cm2	151.630
MS temp: 350 deg	538.275
HRH Pr: 12 Kg/cm2	24.5788
HRH temp: 320 deg	521.469
Boiler PH	7.70544
Cond cation cond.	0.12395

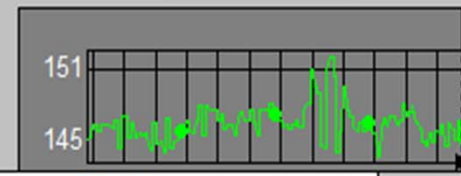
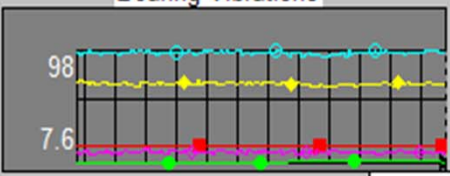
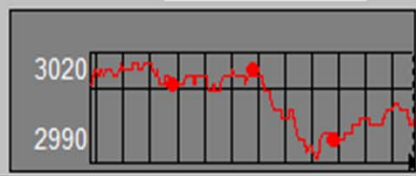
Oil Injection test
Electrical test
Total time at 3000 rpm
Time From step 4 to 5: 6 Hours

Check 5
AVR Auto Auto
H2Cold gastemp 36.1253
Seal oil temp 35.4081

BLK 4,5 FINAL RAMP STABLISH
Raise full load: 200 MW @ 1.5 MW



Prewarming of Turbine ①



Check 1
Barring Speed: 3 to 5 RPM 3002.12
EHC in service NOT_MALFUNCTION
Criteria: ESV opening
Main Stm to CV Chest DT < 50 deg
Criteria:CV opening
HV inner Shell Metal Temp > 165
Speed raising to 1000 rpm

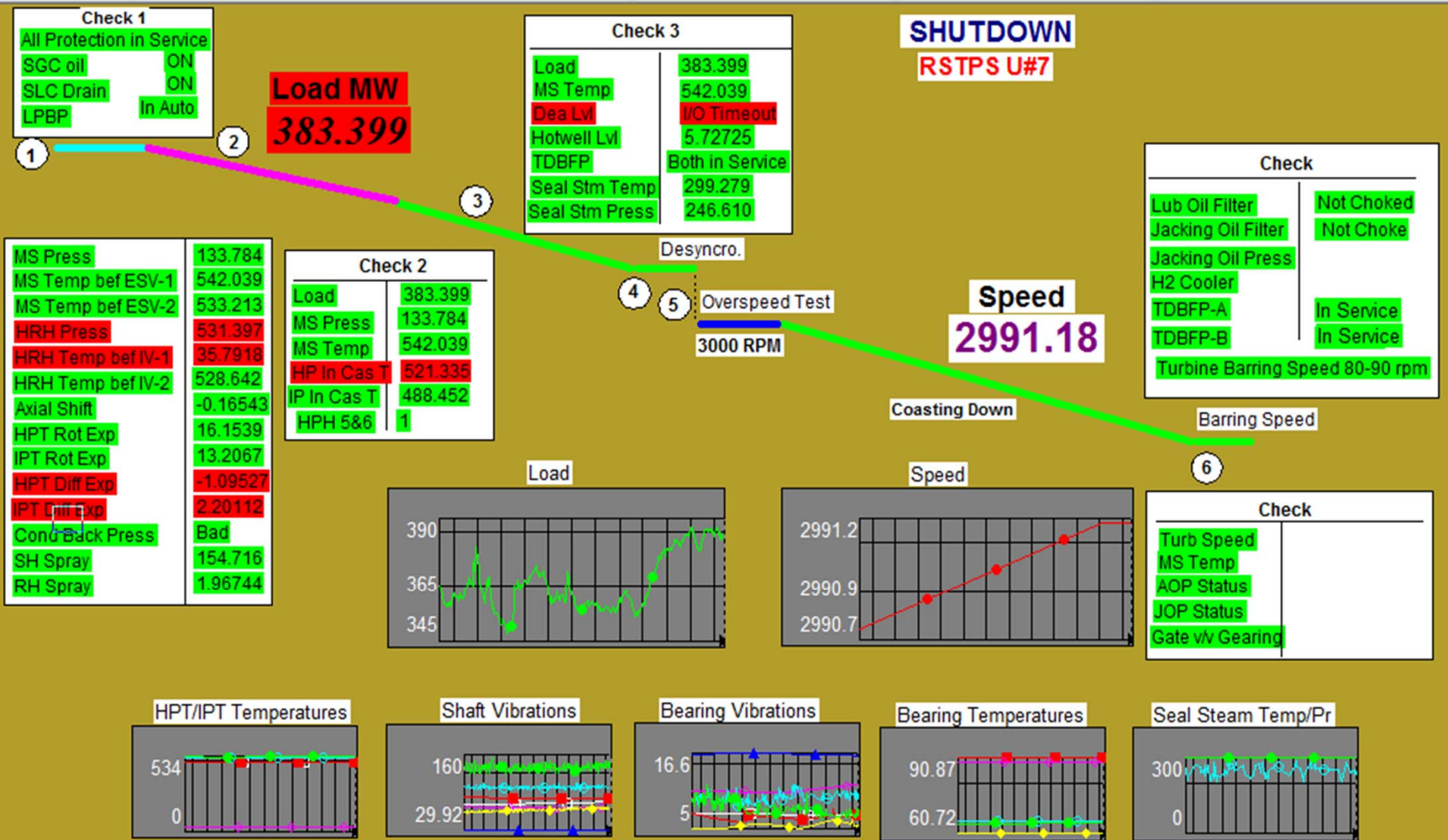
Check 2
Turbine Speed: 1000 RPM 3002.12
All Vibrations With in Limit
Check for all Bearing temp normal
Speed raising from 1000 to 2500 rpm

Check 3
Criteria : Speed raising 3000 rpm
- Accln rate 100 rpm 0
-HRH pr 12 kg/cm2
Block Load : 10 MW
AOP cut out 2800 rpm OFF

Check 7
Load Raising from Block load to 200 MW
Cross Over Pipe Inner Metal Temp >= 175 Deg For 60 Minutes
HP Heaters Charged -1.14373

ROLLING
BLOCKWISE

Non-routine Operations : Shut-Down

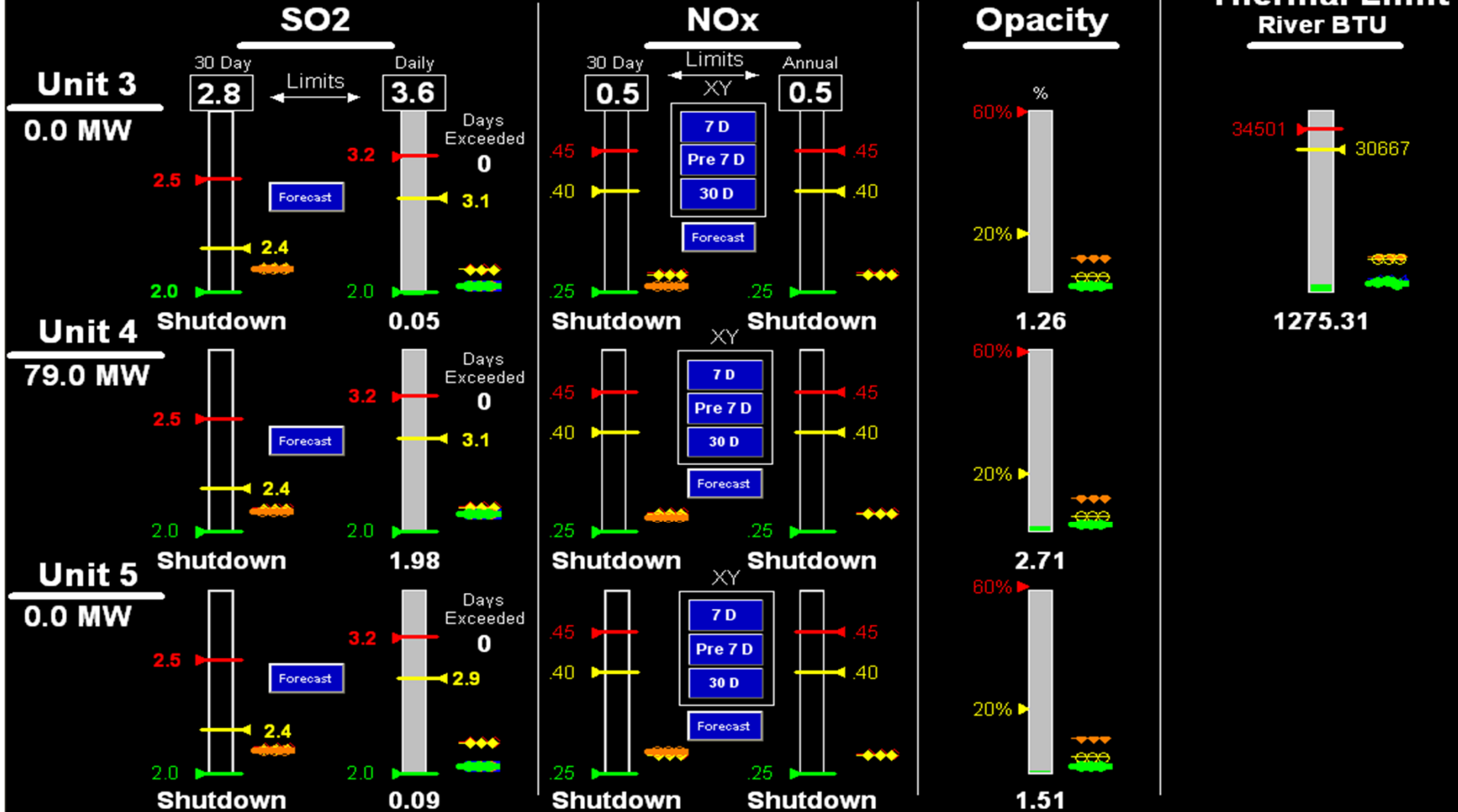


Environmental Monitoring



Environmental Monitoring Summary

5/20/2009 8:19:13.01501 AM



Advanced Pattern Recognition (APR) Modeling



Predictive Analytics leverages the PI system

- *Computers working for you!*
- Reduces Manual Monitoring
- Detects anomalies across a fleet of assets
- Early detection of slow developing failure
- Multiple sensor models, not just a single signal
 - Avoiding failures
 - Supporting Operations
 - Optimizing Maintenance

*Rules based monitoring of critical systems.
Computer models watching the data all the time.*

Advanced Pattern Recognition (APR)



Early Equipment Failure Detection Scope (APR) SmartSignal EPIcenter

- 78 coal & natural gas units 17,000+ MW power
- Critical equipment and systems
- 1600+ models, using 35K+ sensors
- Models run every 5 minutes!
- Goals
 - Early warning impending issues
 - Positive impact on maintenance and operations
 - Minimize Forced Outages

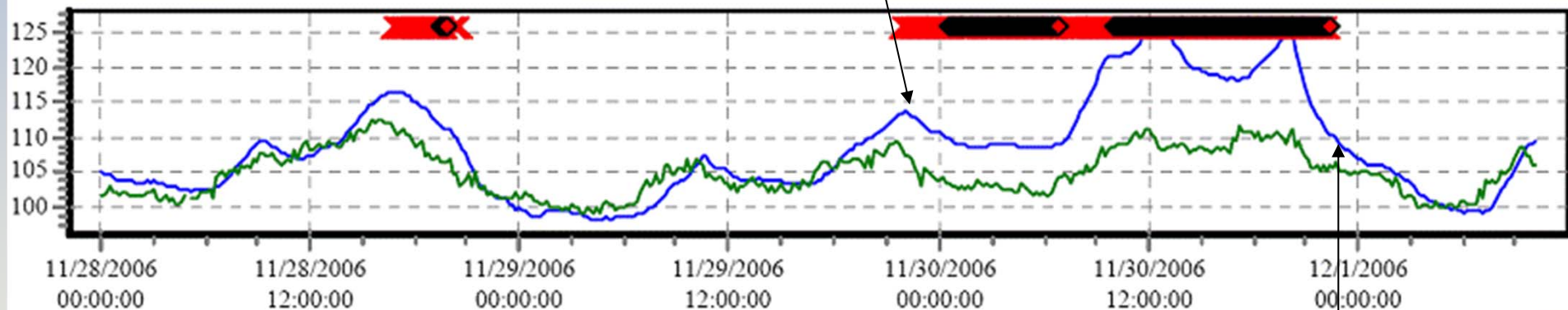
Early warning notifications to plant and subject matter experts

Catch- Fan Motor Bearing



This is a pretty significant movement on FD Fan Motor outboard bearing (about 17 degrees above expected currently).

3D124-3TE273, WEST FD FAN MTR OUTBD BRG (DEGF)



After detection, the filters were found dirty, replaced, and the oil level and temps are dropping on the motor after the change out.

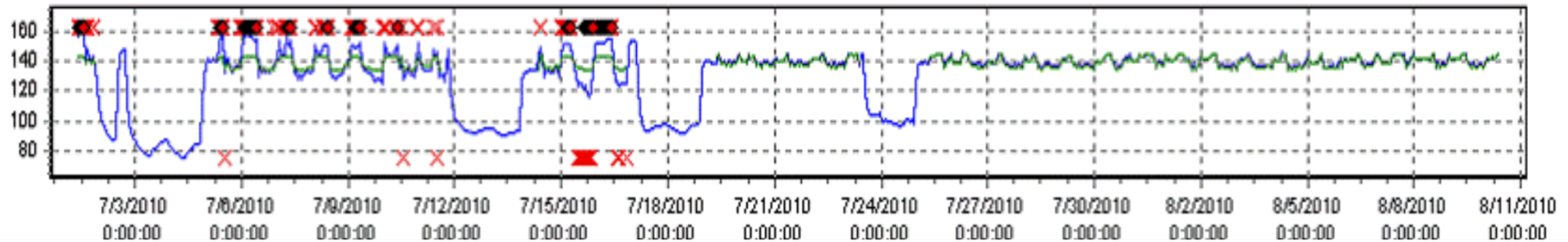
Multiple "Catches"



AI_9_TE_203_A-ED MTR WDG TEMP (DEG C)

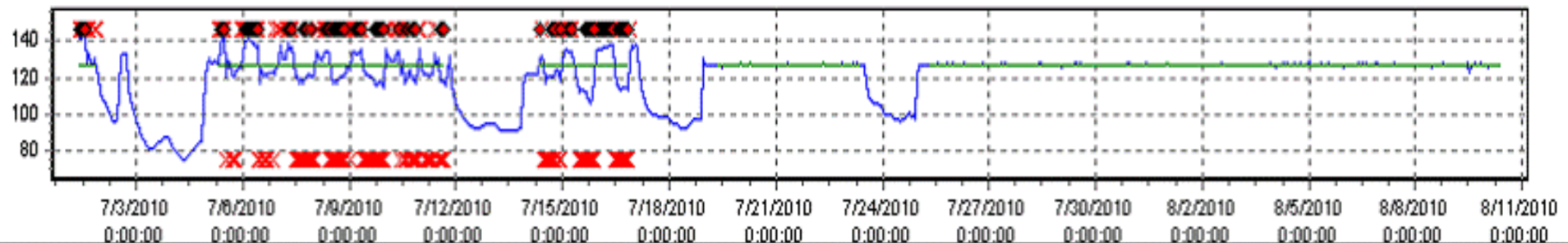
143.2969, 8/8/2010 11:26:48 AM

HC_5BCASCTL_5TT7640, 5 FDF OIL CL IN TEMP, DEG F - (LUBE_OIL_CLR_OIL_INLET_TEMP)



126.4082, 8/8/2010 11:26:48 AM

HC_5BCASCTL_5TT7625, 5 FDF OIL CL OUT TMP, DEG F - (LUBE_OIL_CLR_OIL_DISCH_TEMP)



These Catches were all Keepers!

PMDG Predictive Maintenance



GenOn

Risk Management Risk Assessment **PDM** Work Management LMO CARD Links Advanced Search Back

Search

CONEMAUGH

Go

- CONEMAUGH
 - CON-00
 - CON-01
 - CON-01-AB
 - CON-01-BA
 - CON-01-BB
 - CON-01-BC
 - CON-01-BD
 - CON-01-BE
 - CON-01-BI
 - CON-01-BK
 - CON-01-BN
 - CON-01-CA
 - CON-01-CB
 - CON-01-CB-FDA-
 - CON-01-CB-FDB-
 - CON-01-CB-FDC-

Critical Equipment Only

Discussions

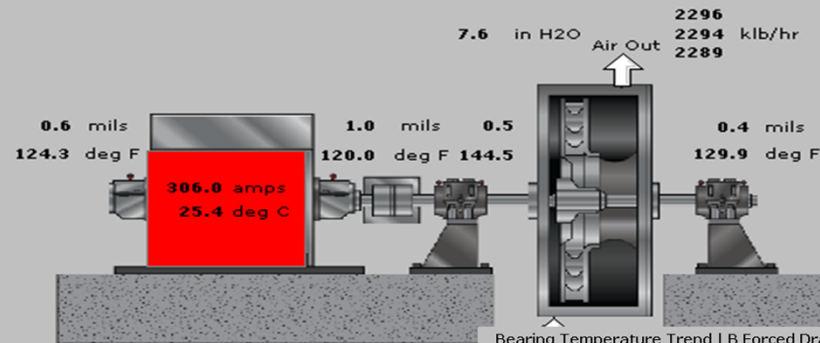
Reliability Discussion Board

PI

B Forced Draft Fan - Unit 1

Unit 1 Unit 2 Overview

720 Gross MW
600 Net MW
-0 Dispatch Limit MW
41 Bus Price (\$)
25 Ambient Temp (F)



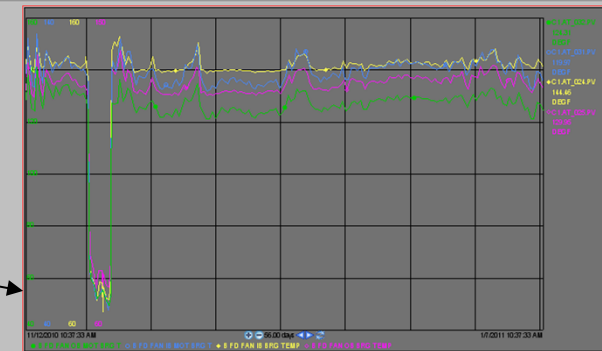
Bearing Temperature Trend | B Forced Draft Fan - Unit 1

-0.5 ir

Unit 1 Unit 2 Overview

600 Gross MW
600 Net MW
-9 Dispatch Limit MW
41 Bus Price (\$)
25 Ambient Temp (F)

59.5	FD Fan Master	PCT
75.2	FD Fan Master-PV	PCT
75.4	FD Fan Master-SP	PCT
59.8	FD Auto/Man	PCT
59.8	Fan Demand	PCT



Vibration Bearing Temp Motor Data

Vibration Bearing Temp Motor Data Fan Data Process Data

OSIsoft PI screens were created and linked to the hierarchy. These screens are interactive and typically drill down to trend plots for key parameters and drill upward for system overviews.

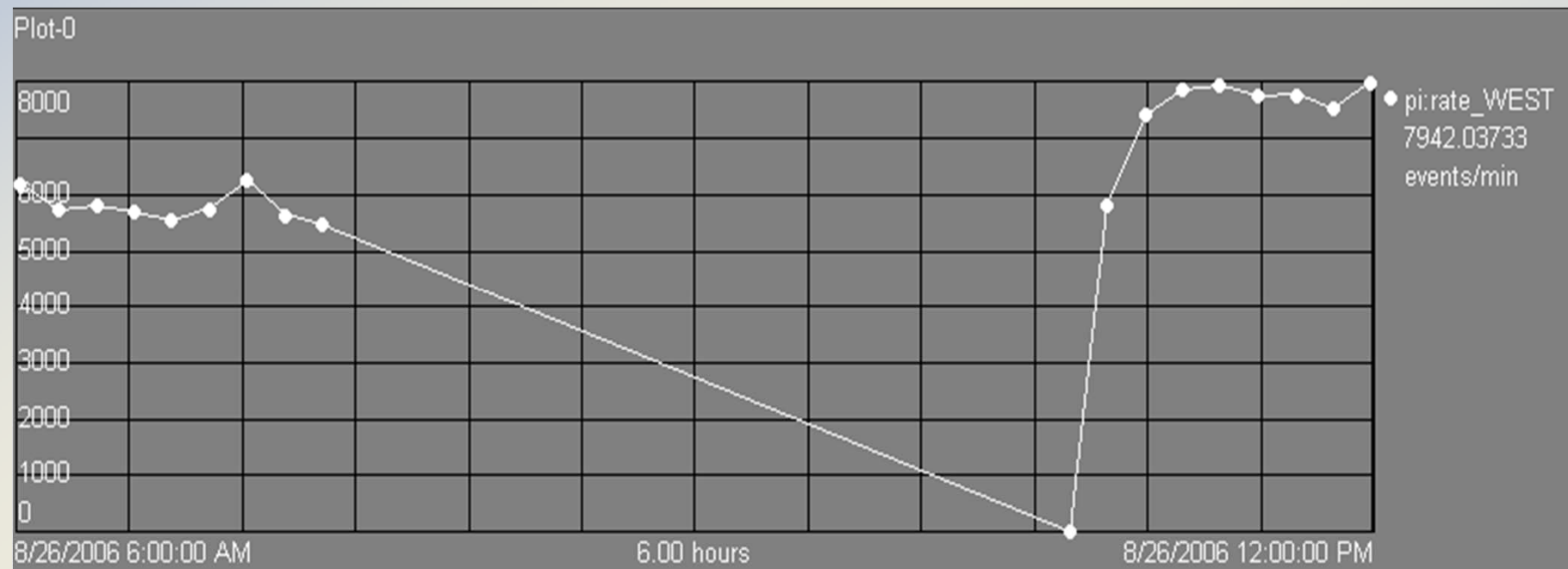
Reverse navigation capability allows a user to start at a OSI PI screen and find where the equipment is located in the hierarchy.

The Challenge



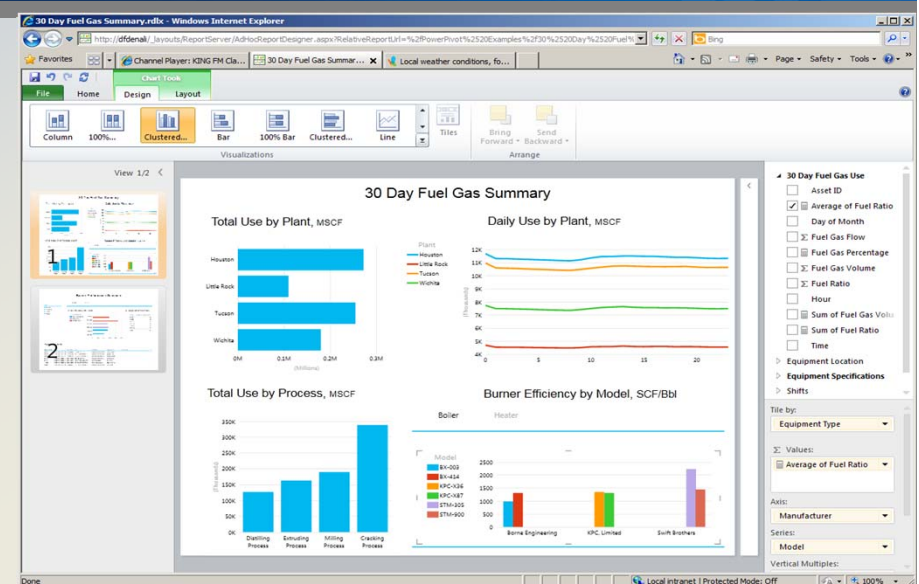
So much data, So little time...

- Larger systems
- Data tsunami
- How can we mine the data for information?





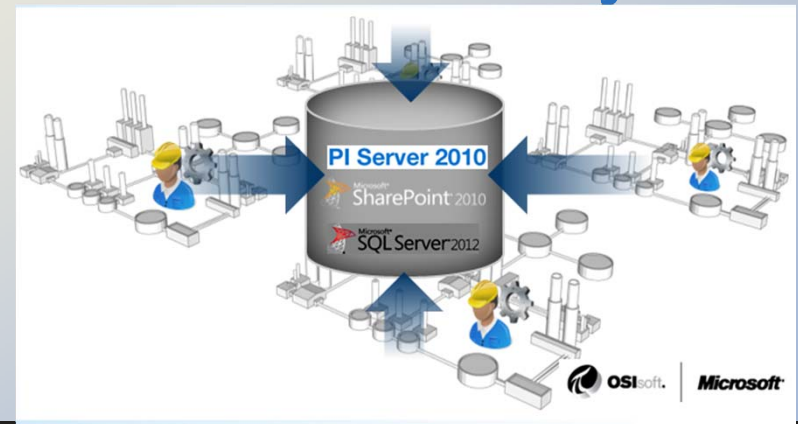
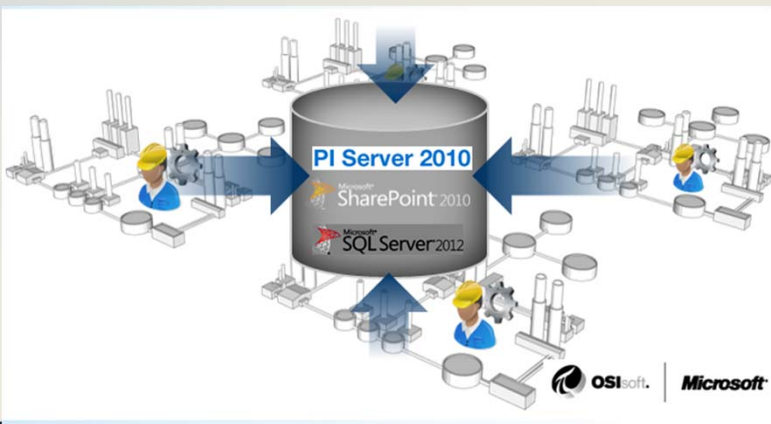
Business Analytics & the Power of Data



PI Coresight™
Analyze Real-time



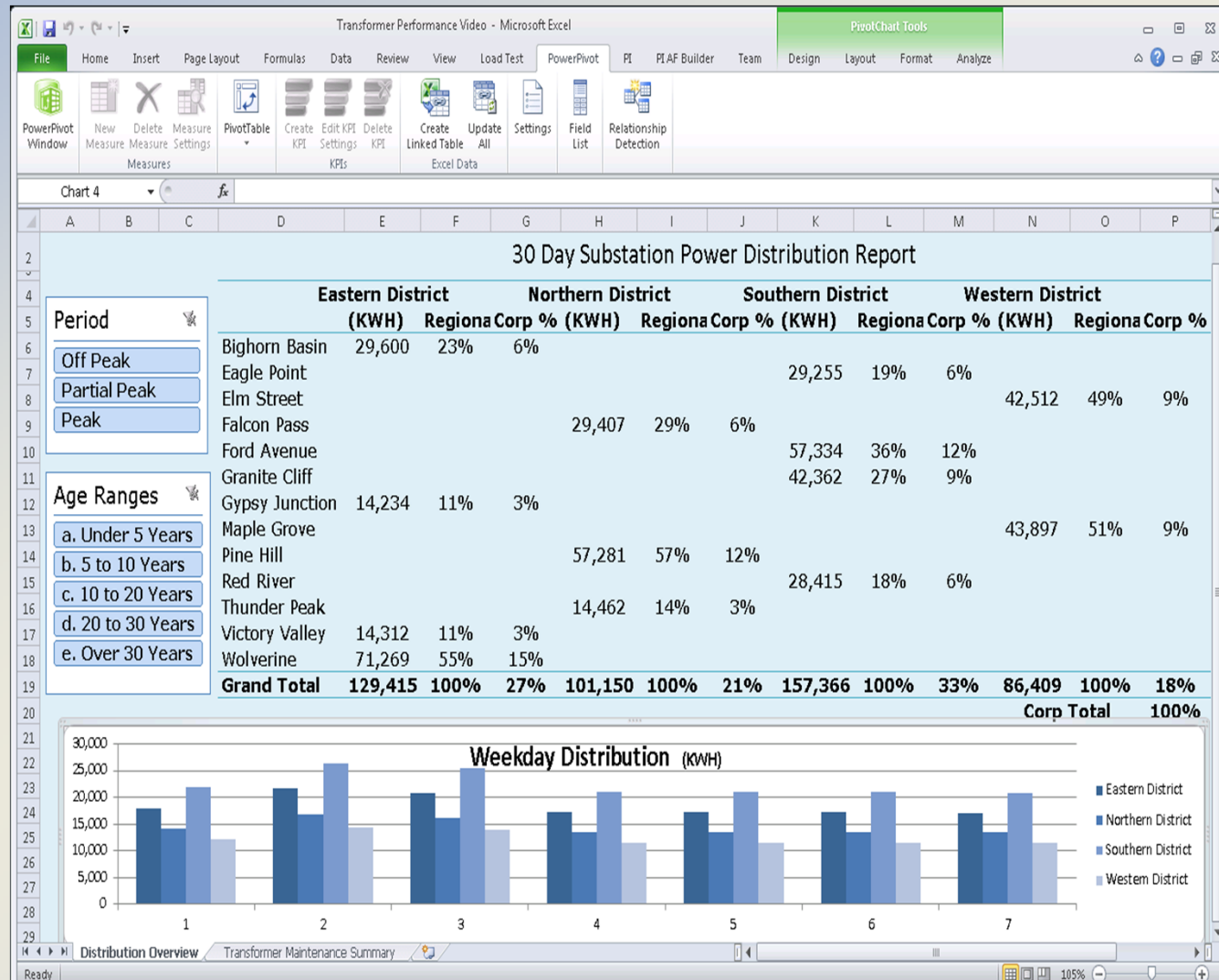
Microsoft Power View
Interactive Analysis



Microsoft PowerPivot for Excel 2010

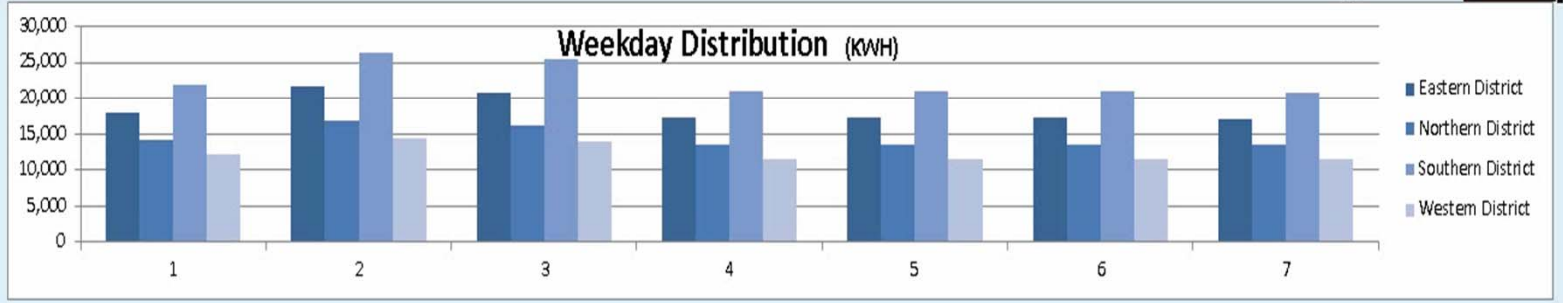


Substation Power Distribution Report



30 Day Substation Power Distribution Report

Period	Eastern District			Northern District			Southern District			Western District		
	(KWH)	Regiona Corp %	(KWH)	Regiona Corp %	(KWH)	Regiona Corp %	(KWH)	Regiona Corp %	(KWH)	Regiona Corp %		
Off Peak	Bighorn Basin	29,600	23%	6%								
Partial Peak	Eagle Point					29,255	19%	6%				
Peak	Elm Street								42,512	49%	9%	
	Falcon Pass			29,407	29%	6%						
	Ford Avenue					57,334	36%	12%				
	Granite Cliff					42,362	27%	9%				
a. Under 5 Years	Gypsy Junction	14,234	11%	3%								
b. 5 to 10 Years	Maple Grove								43,897	51%	9%	
c. 10 to 20 Years	Pine Hill			57,281	57%	12%						
d. 20 to 30 Years	Red River					28,415	18%	6%				
e. Over 30 Years	Thunder Peak			14,462	14%	3%						
	Victory Valley	14,312	11%	3%								
	Wolverine	71,269	55%	15%								
	Grand Total	129,415	100%	27%	101,150	100%	21%	157,366	100%	33%	86,409	100%
											Corp Total	100%



File Home

Paste Text Box New View

Clipboard Insert Views

Segoe UI Light 28

B I U A⁺ A⁻ \$ % ↵ ↲ ↳ ↴

Alignment Arrange


Fit To Window Reading Mode Full Screen Filters Area

Display Filters

View 1/1

Regional Power Distribution

To build a data visualization, select fields in the field list or drag them to the view



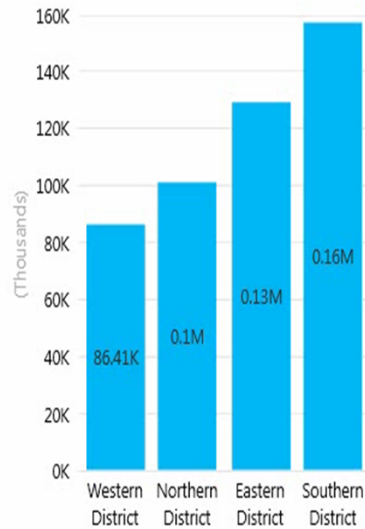
- ▶ Equipment Location
- ▶ Equipment Specifications
- ▶ Latest DGA
- ▶ Rates
- ▶ Transformer Performance

Fields:

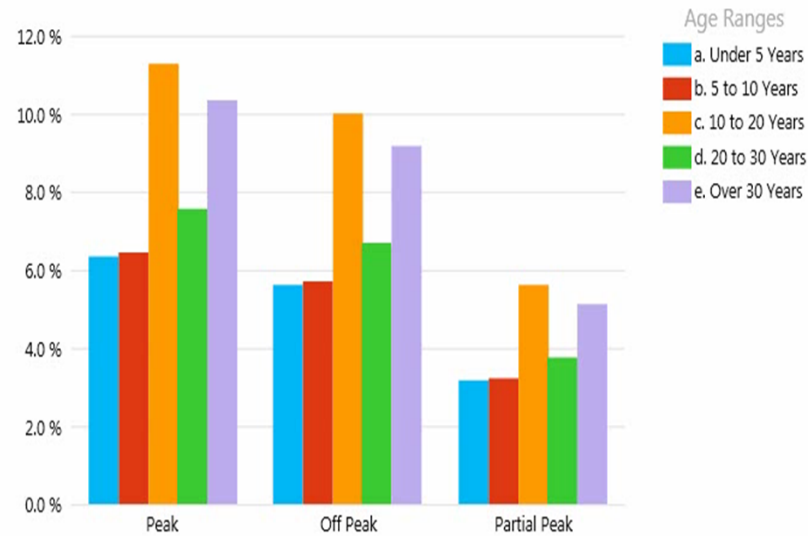
Drag a field here

Regional Power Distribution - Past 30 Days

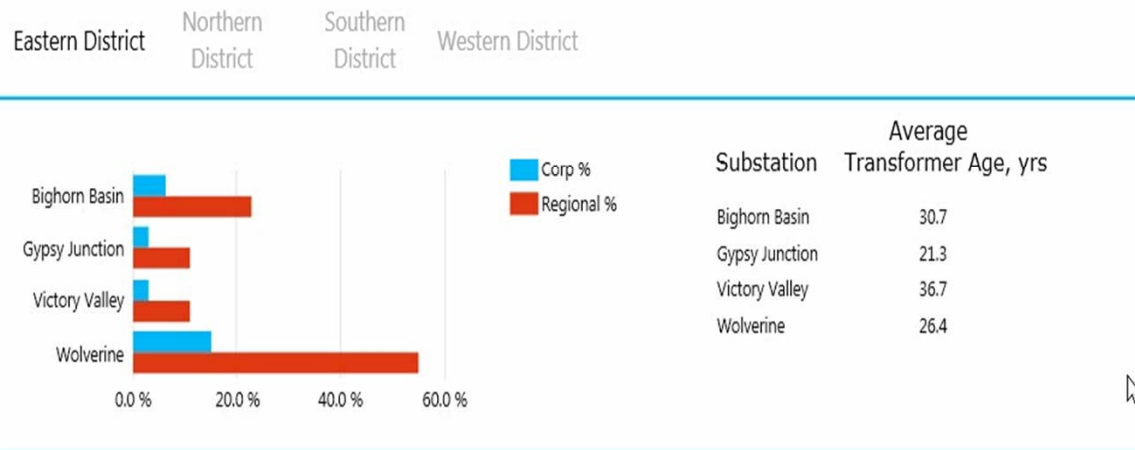
Regional Distribution, KWH



Rate Distribution by Transformer Age,



Substation Distribution, %



In Summary..



Every OSIsoft Phase has positive Power Gen ROI

- Implement an Enterprise Wide correlated Plant real-time data and event Infrastructure (EWI)
 - “get everything” at the plant, create a comprehensive, time synchronized correlated database
 - DCS, analyzers, vibrations, CEMS (emissions), PLCs, weather, mkt prices...
 - Common tool set and training
 - Standard platform for application development
 - Cost effective instrumentation projects (much lower than DCS vendors)
- Leverage EWI for core business processes
 - Operations, Maintenance, Engineering, equipment and vendor performance
 - Common Tools, Visuals, Notifications & Training
 - Build Common Solutions and Advanced Analytics
 - Leverage staff and expand their skills sets
 - site to site, central to site... from anywhere

Thank You and Q&A



Question & Answer

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